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Frequency of Low Bone Mineral Density and Its Age and Gender Related Association in Pakistani Population

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ABSTRACT

Objective: To determine the frequency of low bone mineral density and its probable association with age and gender in Pakistani populations in suburban areas of Lahore.

Study Design: Cross-sectional study

Place and Duration of Study: Combined Military Hospital, Lahore Pakistan, from Feb to May 2018.

Methodology: In this study, 249 subjects were selected through non-probability convenience sampling. Information was endorsed in a pre-designed questionnaire after taking a brief history from all patients. The OsteoSys bone densitometer was used to calculate bone mineral density. To assess bone mineral density and the risk of osteopenia and osteoporosis, T-scores were used. In addition, to maximise accuracy and decrease the chance of error, we calibrated the machine before its use.

Results: Osteoporosis was found in 91(36.54%) and osteopenia in 146(58.63%) of participants. Only 12(4.81%) had normal bone mineral density. A significant association of decreased bone mineral density with increasing age was seen (p-value ≤ 0.001).

Conclusion: This study revealed a high frequency of low bone mineral density in both genders of the Pakistani suburban population. The frequency increased with advancing age and post-menopausal status.

Keywords: Bone density, Osteopenia, Osteoporosis.

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INTRODUCTION

Osteoporosis can be primary or secondary type and it affects both genders. Primary osteoporosis is further classified as type-1 osteoporosis, also called postmenopausal osteoporosis, caused by the deficiency of oestrogen, mainly affecting the trabecular bone.[1,2] Senile osteoporosis, which is type-2 primary osteoporosis, is associated with bone mass loss as cortical and trabecular bones age. Secondary osteoporosis is caused by certain diseases. Osteoporosis has no specific signs and symptoms, and because its diagnosis is wholly dependent on low bone mineral density, it may be considered a silent disease, which most of the time comes to light only when it causes a fracture.[3,4]

Previously, few studies were conducted in Pakistan to determine the frequency of osteoporosis. Although data is still scarce in this regard, available literature has shown a very high frequency of low BMD in Pakistan, as seen in one of the studies quoted here, where the frequency of osteoporosis was 30.7% and that of osteopenia was 44.5% (making the overall frequency of low bone mineral density more than 75%).[5,6] Treatment of low BMD (osteopenia and osteoporosis) is not easy. Literature has shown that active interventions carried out to preserve the normal architecture of damaged bones in order to prevent major complications like fragility fractures have proven beneficial. Novel anabolic bone drugs like Abaloparatide and Romosozumab have been used with success to improve bone formation, mass, and bone strength more efficiently than bisphosphonates.[7,8] The Bone Health Update 2022 stated that both bones and muscles are hormone-sensitive. The females are sensitive because of falling oestrogen levels with their increasing age and are thus more likely to suffer from osteoporosis.[9]

The International Osteoporosis Foundation also stated that it is vital to look for adherence to bisphosphonate therapy in osteoporotic patients. A TRIO study was done, and it was suggested that propeptides of type-I procollagen (PINP) and beta-C-terminal telopeptide (CTX) be measured at the start of treatment and 3 months later to see if there was a drop

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above the least significant change, which was more than 38% for PINP and 56% for CTX. It was concluded that if a significant decrease is observed, the treatment can continue; if no decrease occurs, reassessment to identify problems with the treatment should be done.[10]

Given the high prevalence of osteoporosis worldwide and the paucity of available data regarding its frequency in Pakistan, this study was carried out especially in suburban areas of Lahore, which represent the bulk of the population.

METHODOLOGY

The cross-sectional study was carried out at Combined Military Hospital, Lahore from February to May 2018 including patients from different suburban areas of Lahore, like Memood Booty and Shahdara, after formal approval from the Ethical Committee (ERC No. 110/2018). The sample size was calculated using the WHO sample size calculator, with a reported osteoporosis frequency of 75%.[6]

Inclusion Criteria: Individuals of either gender, aged > 10 and <80 years, and otherwise asymptomatic were included.

Exclusion Criteria: Patients with a history of long bone fractures without apparent trauma, chronic kidney disease, active cancer, musculoskeletal disorders, ankylosing spondylitis, a history of thyroxine intake, and pregnant women were excluded.

Informed consent was obtained from all patients. They were given a detailed explanation of the study's purpose and the use of this data for research. Demographic information was endorsed in a pre-designed questionnaire after taking a brief history of all patients. In addition, information about socioeconomic status, dietary habits, lifestyle, daily exercise, tobacco consumption, living area, and co-morbid conditions was gathered and recorded.

The OsteoSys bone densitometer was used to calculate bone mineral density. Every patient's heel was subjected to a broadband ultrasonic beam that measured calcaneal density in g/cm^2 using the BQI index. The test was conducted by a skilled technician in the field. To assess bone mineral density and the risk of osteopenia and osteoporosis, T-scores were used. In addition, to maximise accuracy and decrease the chance of error, we calibrated the machine before its use.

Statistical Package for Social Sciences (SPSS) version 20.0 was used for the data analysis. Quantitative variables with normal distribution were expressed as Mean±SD and qualitative variables were expressed as frequency and percentages. Chi-square test was applied to explore the inferential statistics. The *p*-value of ≤0.05 was considered statistically significant

RESULTS

A total of 249 participants were part of this study. The general characteristics of the study participants are summarised in Table. The age range was 10-80 years, with a mean of 36.70±1.58 years. Study groups were divided into groups A and B based on age. Group-A (<45 years) consisted of 192(77.10%), while Group- B (>45 years) had 57(22.89%) of the study subjects. The study population consisted of 70(28.11%) males and 179(71.88%) females. Among females, 134(74.86%) were pre-menopausal, and 45(25.13%) were post-menopausal.4.82% of our study population had normal BMD (bone mineral density), while a major proportion, i.e., 58.63%, was osteopenic, and 36.55% was osteoporotic based on T-Score (normal=>-1, osteopenia = -1 to -2.5, osteoporosis =< -2.5), as shown in Figure.

Table: Baseline Characteristics of the Study Participants (n=249)

Characteristics	Study Groups		*p*-value
	Group-A (n=192)	Group-B (n=57)	
Gender, n(%)			
Male	58(23.29%)	12(4.81%)	0.085
Female	134(53.81%)	45(18.07%)	
Menopausal status (Females), n(%)			
Pre-menopausal	134(74.86%)	0	<0.001
Post-menopausal	0	45(25.13%)	

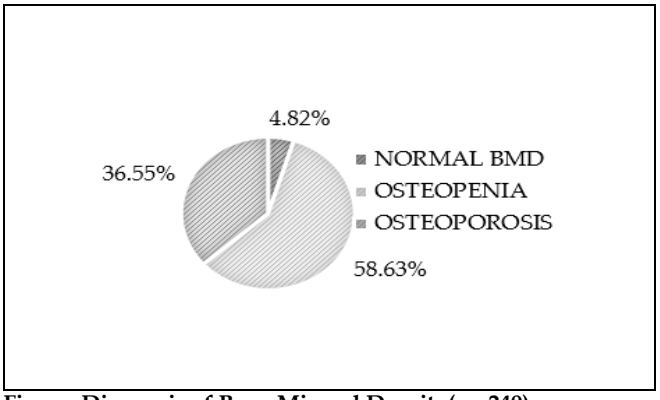

Figure: Diagnosis of Bone Mineral Density(n= 249)

DISCUSSION

The primary objective of this research was to find out the frequency of low bone mineral density in the Pakistani population living in sub-urban areas of Lahore, the capital city of Punjab province. The

secondary goal was to investigate any potential correlation between this issue and the age, gender, or menopausal status of this specific study group. According to our study results, the majority of the study population had low BMD in the form of osteopenia and osteoporosis, while only 5% had normal low bone mineral. A similar study carried out in Karachi, Pakistan, to look for the frequency of osteoporosis in the local population showed comparable results, with a high frequency of osteopenia and osteoporosis in their study population and fewer subjects with normal bone mineral density.[11]

In this particular study, the frequency of decreased bone density increased with age. The results are comparable to other studies available in the literature, like a study done by Gupta *et al*. which also demonstrated a significant association between osteoporosis and advancing age (>70 years).[12]

This study observed that osteopenia was highly prevalent in both pre-menopausal and post-menopausal groups, but osteoporosis was more prevalent in post-menopausal females. Similar to our study results, a cross-sectional study carried out at DOW University demonstrated that osteopenia is equally prevalent in females in Pakistan, irrespective of menopausal status, whereas osteoporosis is found to be more prevalent in postmenopausal women.[13] Comparable to our study results, a few other studies, like one by Ji *et al*. and another published in Lancet, showed that postmenopausal females had a higher frequency of osteoporosis than their premenopausal counterparts.[14,15]

Our study did not demonstrate a statistically significant association of osteoporosis with any gender in particular. Men and women had almost identical osteopenia and osteoporosis trends; similar results are seen in an international study conducted across Queensland, Australia.[16] However, in contrast to our study, a cross-sectional study carried out in India showed that absolute low bone mineral was higher in male subjects (p-< 0.001) as compared to female counterparts. Furthermore, the frequency of osteoporosis increased significantly with age in female subjects compared to male subjects in the study.[17]

Considering the high frequency of decreased BMD in our study, especially in sub-urban areas, multi-centred, large-scale studies should be performed in Pakistan to assess the aetiology and risk factors associated with it. Early screening of the general population is required to assess the true picture of bone mineral density status.[18]

CONCLUSION

This study revealed a higher frequency of decreased bone mineral density in the form of osteopenia and osteoporosis in both genders of the Pakistani suburban population. The frequency increased with advancing age and post-menopausal status.

Conflict of Interest: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MF & SS: Conception, study design, drafting the manuscript, approval of the final version to be published.

MF & HZ: Data acquisition, data analysis, drafting the manuscript, critical review, approval of the final version to be published.

AS: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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